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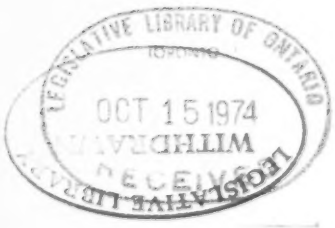
PRELIMINARY REPORT



GEOLOGY OF THE

BEAUCHENE AND BLEU LAKES AREA

MAURICE RIVE

1973

REVISED TEXT

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INTRODUCTION

The region of Lakes Beauchêne and Bleu, mapped during the summer of 1969, has its northern boundary at latitude 46°45'; it extends as far as 78°00' longitude; to the south and west the Ottawa river is the boundary line. It covers about 1,500 square miles, and its center lies about 35 miles southeast of Témiscaming. The Magnasipi East map (1:50,000) adjoining the southeastern extremity of this region was the object of a study during the summer of 1968 (Rive, 1970).

The main access to all the northern part of the territory is the road connecting Kipawa and Fils lake. Several of the secondary roads link up with it, permitting access to Memewin lake and Snake creek, Bleu, Booth and Jardins lakes.

The only access road to the southeastern part of the region is that leading from Deux-Rivières and ending at Six Milles lake. Two miles north of Deux-Rivières a road branches off to lead to the confines of Smith lake, some five miles west.

Aside from the Ottawa, there are several gentle rivers, such as the Jardins which is easily navigable and serves as an outlet for Jardins lake as well as Bleu lake, and running north, empties into the Kipawa river. We should also mention the Beauchêne which flows into the Ottawa after a winding course that is generally westward. We also have the Maganasipi and the Fildegrand rivers running south into the Ottawa. These last three are not navigable.

When we consider the various methods of travel (roads, lakes, rivers, hydroplane) we find the only region that is difficult to reach is the central part of the area bordering on Allouez and Edwards townships.

The relief consists of a succession of hills ranging in altitude from 150 to 250 feet, with their orientation following the structural trends. It becomes precipitous to the east of Témiscamingue and in the section bordering the Ottawa where gradients reach 600 feet. Some huge depressions of glacial origin and characterized by rolling terrain are actually filled with lakes such as those in the region of Beauchêne, Bleu and Jardins lakes, where glacial deposits of sand, with and without shingle, are to be found.

The territories north of latitude 46°45' were studied by J.L. Robert (1963) and H.B. Lyall (1959).

GENERAL GEOLOGY

Among the formations encounted, we have distinguished three groups.

The first has undergone one or more periods of strain. It is made up of: a) hornblende gneisses and biotite gneiss, with pink gneisses often directly associated with them; in which case they are mapped as "mixed gneisses"; b) leucocratic quartzofeldspathic gneisses, with or without muscovite; c) grey, biotite gneisses, capable of forming a thick complex when they alternate with the leucocratic gneisses; and finally d) a formation of metasedimentary rocks, each characterized by one or more petrographic facies. We could also distinguish:

i) the metasedimentary Kipawa Formation, wherein muscovite schists and quartzites are dominant

ii) the garnetiferous, biotite gneiss formation of Bleu lake

iii) the metasedimentary formations of Booth lake, Snake creek and Fils lake. These are characterized by the presence of garnetiferous, aluminium silicate paragneiss, graphite paragneiss, calc-silicate rocks, garnetiferous biotite or biotite and hornblende gneiss. Several lenticular massifs of monzonite appear in the region of Snake creek and Fils lake.

The second group is post-tectonic. It is made up of gabbros, diabases and certain pegmatites.

Finally, we have the third group which is composed of sedimentary rocks that are the polypary limestones found on the northern bank of the Ottawa, four miles east of Deux-Rivières.

Table of Formations

Pleistocene	Sand, gravel, boulders, clay
Paleozoic	Polypary limestone (Ordovician)
Precambrian	Gabbro, diabase
	Monzonite Paragneiss of Booth lake, Snake creek and Fils lake Garnetiferous biotite gneiss of Bleu lake Kipawa schist and quartzite Mixed gneisses, hornblende gneiss Pink, leucocratic quartzofeldspathic gneiss Gray gneiss, foliated, augen, or quartzofeldspathic

Gray biotite-gneiss

The main constituents of the gray, biotite gneisses are quartz, biotite and plagioclase. They are medium grained (1.5 mm), light to dark gray, and variable in texture.

Foliated gneiss - One banded facies was found characterized by the alternation of mesocratic bands, 3 to 4 cm. thick, rich in biotite, with a regular foliation and leucocratic bands of quartzofeldspathic material with a rough foliation, sparse biotite, in which the grain size may reach 2 to 2.5 mm. These banded gneisses underlie the paragneisses, notably in the Spearman lake and Fils lake areas.

Augen gneiss - There is another facies, particularly abundant in the central part of Jardins lake; it consists of a biotite gneiss with an amygdaloidal or augen tendency characterized by small (1 to 3 cm. long) ovoid or elliptical masses containing alkaline feldspar. This facies is found alongside the leucocratic quartzofeldspathic gneisses, notably in the whole area north and northeast of Jardins lake as well as in the southwest part of the

map-area where it is often associated with the banded gneisses. The two facies, foliated and amygdaloidal gneiss, have been mapped under the heading of foliated gneisses.

Quartzofeldspathic gneiss - These correspond in composition to those in the banded gneiss beds mentioned previously. They show many indications of remobilization such as beds, lenses, phenocrysts or amygdaloids rich in alkaline feldspar. They are abundant to the east of Témiscaming, to the north of Lake des Jardins, and to the east of Lake Memewin. They seem to be the deep-seated expression of the biotite gneisses, and the transition from one to the other is steadily progressive.

Complex - The association of gray gneisses with the leucocratic quartzofeldspathic gneisses is characterized by a huge complex, described below. It is well exposed and may be easily observed in the following areas: 6 miles east of Memewin lake; in the region extending north of Mattawa; and in sectors of Beaubel lake and Little Lake des Jardins. It corresponds to the formations mapped farther east under the name "migmatites".

Leucocratic Quartzofeldspathic Gneiss

These are massive, medium grained (2 mm), white, gray, or pink rocks, rich in quartz and feldspar. The quartz, which varies up to 30%, is generally covered by a very thin film of hematite which colours it red or pink. These leucocratic gneisses occur in beds of considerable thickness in the Témiscaming region and in the area extending about 4 miles south of Beaubel lake. They contain numerous small magnetite crystals.

The quartzofeldspathic gneisses can sometime contain lamella of muscovite scattered throughout the rock, or concentrated in thin, even layers (4 mm), or at other times lamella of mica schist. In this muscovite facies the percentage of quartz varies greatly (up to 50%). From time to time, layers of impure quartzite are visible, as may be observed along the road from Deux-Rivières to Six Milles lake, 4 miles south of Beaubel lake. This muscovite facies outcrops in the middle of the town of Témiscamingue and also about 3 miles south of Beaubel lake.

Hornblende Gneisses and Mixed Gneisses

These hornblende gneisses are dark green, medium-grained and contain from 20 to 30 per cent hornblende. They grade locally into amphibolites. Often they have small epidote crystals scattered throughout or concentrated in thin layers. We may observe this on the road to Tête d'Original lake at a place some 1000 feet east of the club. When large enough, they were separatly mapped. This is notably the case along the railway track between Holden and Elma stations, in the area around the south shore of Lake Memewin, and northeast of Lake Marin.

The mixed gneisses are a heterogeneous formation composed of hornblende gneisses, biotite gneisses and the pink gneisses directly associated with them in alternating beds which sometimes reach a thickness of 10 metres. There are outcrops of mixed gneiss throughout the area between Tête d'Orignal lake and the Ottawa. We also find some in the immediate vicinity of La Cave dam, on the Ottawa four miles upstream from Mattawa, and northeast of Lake McCracken.

The biotite gneisses have the same grain and the same percentage of biotite as the Bleu Lake paragneisses previously described but they do not present the same evidence of remobilization and they also lack garnet.

The pink gneisses may be bedded or massive and correspond to the quartzofeldspathic gneiss described above. The percentage of alkaline feldspar varies (3 to 40%). We also found some very thin beds of gray, granitic gneiss impregnated with swirls of pink material rich in alkaline feldspar.

Schists and Quartzite (Kipawa Formation)

The Kipawa Formation is characterized by the abundance of muscovite schists and quartzite. It occurs as a band which crosses Smith lake from the northeast to the southwest curving west some 4 miles to the northeast of Beauchêne lake, then skirting the north shore of the lake.

The quartzites are massive, pure, coarsely crystalline and pale to medium gray in colour. Occasionally the homogenity of the rock is disturbed by the appearance of thin (1 to 2 cm) layers of smokey quartz and patches of small hematite crystals. Because of the crumpling these rocks have undergone the thickness of the quartzites is difficult to establish. The main outcrops where we could study the facies were: on the hill overlooking the southwest part of Smith lake; on the mountain which fringes the northern point of the lake, northeast of the fire tower; and in the secondary mountain chain two miles north and northwest of the central part of Beauchêne lake.

Muscovite schists are associated with quartzites. The transition from one to the other results in an impure, muscovite quartzite that is gray-green to bluish green in colour. Besides quartz, the schist may contain muscovite and feldspar, Kyanite, biotite, garnets and tourmaline.

This Kipawa Formation also forms another band oriented east-west along the south shore of Lake Beauchêne. We find, throughout this area, muscovite schists and pink, quartz-feldspar-muscovite gneisses. We also find (more rarely) some impure, muscovite quartzites, graphitic paragneiss, garnet paragneiss, as well as some hornblende, epidote and actinolite amphibolites.

Within the formation, calc-silicate rocks are rare; they may be observed in thin layers (up to 3 cm) on the trail 4 miles northwest of Cottentré lake, and along the Kipawa-Fils Lake road, near the eastern point of Lake Beauchêne, and also at a spot 2 miles west of the western point of this same lake. Here they are associated with the muscovite schists and the graphite paragneisses.

Biotite Paragneiss of Lake Bleu

These biotite paragneisses are a thick, very homogeneous series which crop out mainly through the region stretching west of Bleu lake and in the sector between Spearman and Memewin lakes.

They are medium grained (2 mm), garnetiferous gneisses with subautomorphic feldspar. They are rich (up to 30%) in flakes of fresh-looking biotite of good size (2 - 4 mm) that often show chevron-like folds. Hornblende is common; it occurs locally in euhedral crystals associated with the biotite.

These garnetiferous gneisses often have small (5 to 10 cm) layers of gray, granitic material, extremely crumpled and broken, and locally discordant.

Finally, they appear within the gray, quartzofeldspathic biotite gneisses, into which they grade laterally.

Garnetiferous Paragneisses of Booth Lake, Snake Creek and Fils Lake

These paragneiss comprise biotite-garnet or hornblende-garnet gneiss, graphite gneiss, aluminium silicate gneiss and calc-silicate rocks, as well as layers of amphibolithic leptonite. These different facies are closely imbricated. The outcrops are particularly numerous between Booth and Spearman lakes and between Snake creek and Memewin lake, as well as in the vicinity of Fils lake.

In this paragneissic complex we find the biotite-garnet gneisses differ from those of Bleu lake. The grain is finer (1 - 1.5 mm) and they lack the same forms of remobilization, besides they are very rich in small beds of pink material in which potash feldspar (microcline) is dominant (30%).

Granulation of this feldspar, the drawing out of the various minerals composing the paragneissis, and thin beds of cataclasite are all common.

Finally, in the Booth Lake and Snake Creek layers, we have some massive amphibolites with garnet and, at times, pyroxene phenocrysts (probably orthopyroxene). They occur as sills and are

relatively modest in size (some tens of metres) in comparison to those found around Fils lake (several hundreds of metres). These amphibolites are probably part of a succession of intrusives belonging to the family of mangerites and monzonites.

Monzonite

These rocks are found as lenticular masses in the phyllocrystalline series between Fils lake and Montégron lake as well as west of Carabine lake. The masses are never very thick (some hundreds of metres) but they extend over many miles.

Gabbro and Diabase

These rocks are found in dykes cutting through all the facies mentioned above. At the south end of Snake Creek station we have a very good outcrop in which we see a vertical dyke 5 metres wide. The center is medium-grained gabbro (2 mm), ophitic in structure, and the edges a very fine-grained diabase.

We find many diabase dykes throughout the southwestern part of the region, but they were neither sufficiently long nor wide enough to map. Their direction is northwest or west.

Polypary Limestone (Ordovician)

This limestone is found along the north bank of the Ottawa, 4 miles west of Deux-Rivières. It is a massive fossiliferous limestone and may be followed for some tens of metres. As it has no visible contact with any crystalline strata, it is probably an outlier of the sedimentary rocks framed by the faults which dot the Ottawa valley.

STRUCTURAL GEOLOGY

In the area studied, the north and northeast structural trends are again noticeable, especially in the Lake Bleu paragneiss, northwest of Memewin lake, and in the outcrops in the Témiscaming region. Some folds are overturned to east and southeast. The Booth Lake synform presents a more complex case. It is possible that the fold was marked with an abnormal contact, when we consider that the biotite paragneisses are distributed on either side of the axis.

These trends are truncated by a system of more recent folds, northwest in direction, which predominate in all the central part of the map-area. Some of these synforms present a very individualized form; as particular examples we cite the synform at Bleu lake, the one found northeast of McCracken lake and the antiform 4 miles south of Beaubel lake.

Several diaclastic systems are present: one oriented to the northwest is easily observed throughout the western part of the map-area; a second, notheast in direction, seems to predominate in the sector of Smith and McCracken lakes; the third one, east-west in orientation, can be seen in the section east of Johnson lake.

The rocks which crop out along the shores of the Ottawa between Mattawa and Deux-Rivières often exhibit signs of pulverizing or crushing. It is possible that the river runs along an eastwest fault zone.

Then again we must point out the intense granulation of the porphyroblasts in the region between Smith and McCracken lakes.

METAMORPHISM

The whole area west of a boundary extending from Hamilton lake and following the Ours river farther south, is characterized by the kyanite-muscovite association. To the east of this line we have sillimanite. The hornblende-pyroxene association is seen in the sector between Fils lake and Pin Blanc lake, and locally the rocks have all the characteristics of granulite facies.

To the south, sillimanite is associated with kyanite in the paragneiss layers running to the north of Smith lake.

ECONOMIC GEOLOGY

Uranium

Exploration for uranium in this area had never been intensive until the results of a geochemical survey done by the Department in 1969 on the Kipawa region north of parallel 46°45' were published (Kelly and others 1969). The study indicated clearly that the most interesting geochemical anomalies for uranium coïncided with the presence of quartzite bands. During the summer of 1969 many prospectors explored these bands, which crop out in considerable number in the region stretching two miles north of Beauchêne lake and in the area of Smith lake (see paragraph dealing with the Kipawa Formation).

Some good scintillometer readings were obtained from small beds of smokey quartz we found in the massive quartzites southeast of Lake Smith. Yet, on the whole, these quartzites yielded poor results.

Less spectacular but more consistent readings were obtained from the kyanite and muscovite schists, whose slight radioactively is due to the presence of monazite.

Kyanite

Narco Mines Ltd. is preparing to exploit a kyanite deposit at their mine, 2 miles north of Holden station, alongside the Témiscaming - Ottawa railway line. Opened in 1967, the mine is now in the process or development. Kyanite is used in the manufacture of high-temperature, refractory brick.

It occurs as crystals averaging 2 cm in length, within a muscovite-biotite-garnet-tourmaline schist. We also find it in large crystals (up to 6 cm) inside quartzose lenses, 10 to 60 cm in length, aligned with the foliation of the enclosing schists. These lenses probably correspond to the older quartzose layers in the original sedimentary series. The layers would have undergone intense boudinage as a result of withstanding many deformations. The proportion of kyanite ranges between 15 and 20 per cent.

Some beds of biotite and garnet gneiss, rich in quartz, are to be found in the southeast section of the mine; but the conditions of the deposit do not permit close observation of their bearing on the schists.

This kyanite-rich formation has an average dip of 10^{o} to the southwest. We can follow it in the first spurs of the mountain which flank the mine. Two outcrops of similar rock were found on the trail which goes east from the mine. Beyond this we find only quartz-feldspar and muscovite gneisses of the Kipawa Formation. Southwest of the mine, the formation goes under the Ottawa.

We find kyanite in similar layers, rich in small quartzose lentils, some 500 feet south of a little lake situated about 3,000 feet south of the fire tower at Lake Beauchêne.

It is also found sporadically, often associated with muscovite, but never in quantity sufficient for exploitation. We saw it mainly: a) in the layer of biotite and garnet paragneiss that passes northeast of Spearman lake; b) near Crest station, half-way between Mattawa and Temiscamingue, where it is in a layer of muscovite schist three meters thick; c) in the paragneiss layer to the east of Hamilton lake.

Sillimanite

Sillimanite occurs in considerable amount on the southern shore of a small lake oriented northwest to southeast, two miles north of Smith lake. It appears as prism clusters in the quartz-feldspar gneiss, making up 50% of the outcrop which extends some 200 feet.

Hematite

This material is found as small flattened masses, 2 to 3 cm long, within the quartzites of the Kipawa Formation. It also occurs in larger masses (10 cm. long), oriented parallel to the foliation, near the contact of a concordant pegmatite with a band of quartz-feldspar-muscovite gneiss, located 2000 feet north of Crest station along the right-of-way. The deposit is not of commercial interest.

Graphite

Graphite is present throughout the paragneissis of Lake Booth and Lake du Fils formation, but never in large quantities. The only place we observed it in the Kipawa Formation was two miles west of the western tip of Lake Beauchêne. Here it occurred in a fine-grained gneiss that was rich in quartz and associated with calc-silicate rocks.

We never saw it in the biotite gneisses of Lake Bleu.

Sulphides

These were found in the Fils lake and Booth lake paragneisses; they consist essentially of pyrite and, to a lesser degree, chalcopyrite which occur in small, plurimillimetric crystals or in small elongated masses (2 to 3 cm. long) in the heart of the garnetiferous, biotite gneiss and in quartzose horizons often rich in graphite. Unfortunately, these mineralized horizons are very thin (1 to 3 cm) and although they show a considerable length (several hundreds of metres) they do not appear to hold any great economic interest.

Sulphides were also found within or at the contacts of the basic intrusive rocks such as some gabbros with or without olivine which are quite numerous in the Fils Lake area.

In 1956 and 1957, the Thompson A.C. Company worked in the sector of Pin Blanc lake and the area separating it from Fils lake to the south. This company located small pockets of sulphides on the contacts of basic intrusives, generally in highly folded, often faulted, zones of the paragneiss.

These sulphides consisted of chalcopyrite, pyrite and pentlandite. Some ten diamond-drill holes were drilled and the average tenors encountered were: 0.10% nickel, 0.15% copper and 0.03% cobalt. The basic rocks contain 0.06% nickel and 0.06% copper on the average and at times show segregations of magnetite.

In the Kipawa Group, some small masses of pyrite, pyrrhotite and chalcopyrite were encountered in the calcsilicate rocks and in the massive, grunerite-bearing amphibolites which outcrop along the road running from Kipawa to Fils lake, opposite the east end of Beauchêne lake. This outcrop is isolated on all sides by glacial deposits; it is nevertheless probable that it forms a part of the iron formation found by J.L. Robert some 4 miles northeast of Kipawa.

GEOCHEMISTRY

A total of 279 samples of stream sediments were taken during the course of the geological traverses. The results are shown on the map (No. 1733) accompanying this report and in the following tabulation.

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RESULTS OF ANALYSES

NUMERO NOUV.	ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
1	4326	6	50	16	3	8	0.4	601	0	3.0	15	0
2	4462	10	40	20	0	18	0.4	893	0	4.0	8	0
3	4341	6	50	60	3	13	0.4	128	0	1.0	0	0
4	4201	16	110	20	23	35	0.8	308	0	0.0	17	0
5	4203	10	50	20	13	13	0.6	1812	0	0.5	8	*
6	4202	10	50	36	35	8	*	*	0	0.0	*	0
7	4468	4	25	16	3	8	0.0	83	0	1.0	4	0
8	4472	4	50	16	3	5	0.0	80	0	0.5	6	0
9	4473	30	400	140	48	65	*	*	8	*	*	0
10	4431	2	75	30	6	16	0.4	496	1	6.0	8	0
11	4430	6	25	24	3	8	0.0	55	0	1.0	0	0
12	4220	4	60	20	10	6	0.5	285	0	8.0	18	0
13	4219	10	1100	100	296	56	0.8	77635	0	6.0	30	0
14	4422	2	25	36	5	8	0.0	75	0	0.5	5	0
15	4460	4	40	30	3	5	0.0	326	0	1.0	6	0
16	4459	6	25	80	18	10	0.4	541	0	1.0	6	0
17	4458	6	15	10	3	3	*	*	0	0.0	*	0
18	4457	16	40	16	8	13	0.6	83	0	1.0	14	0
19	4456	16	40	16	0	8	0.0	45	0	0.5	4	0
20	4455	6	15	20	0	5	0.0	30	0	0.0	6	0
21	4454	10	25	40	0	10	0.0	37	0	1.0	0	0
22	4453	4	25	16	0	5	0.0	45	0	0.5	5	0
23	4452	2	40	16	0	5	*	*	0	1.0	*	0
24	4451	2	40	20	0	3	0.0	53	0	1.0	4	0
25	4450	4	50	20	0	3	0.0	62	0	1.0	6	0
26	4449	2	15	30	0	8	0.0	97	0	1.0	8	0
27	4446	0	40	16	0	13	0.0	195	0	1.0	6	0
28	4445	0	25	20	3	5	0.0	30	0	0.5	0	0
29	4447	0	25	16	0	13	0.0	103	0	1.0	0	0
30	4448	0	25	30	3	8	0.0	95	0	0.5	6	0
31	4252	6	50	10	13	13	*	*	0	*	*	*
32	4466	10	50	20	0	10	0.0	233	0	1.0	6	0
33	4465	4	40	16	0	8	0.4	55	0	0.5	5	0
34	4463	2	25	20	0	8	0.0	57	0	0.0	0	0
35	4464	10	40	16	0	15	0.0	93	0	0.5	4	0
36	4342	6	15	30	3	8	0.0	85	0	1.0	5	0
37	4343	6	15	40	5	13	0.0	123	0	0.5	7	0
38	4467	30	50	20	3	18	0.0	443	0	2.0	9	0
39	4344	4	50	30	8	15	*	*	0	1.0	*	*
40	4469	6	25	16	3	8	0.0	107	0	1.0	0	0
41	4345	40	90	30	6	36	*	*	0	*	*	*
42	4417	40	500	30	48	63	0.7	3948	12	14.0	37	0
43	4470	6	40	30	3	5	0.0	77	0	1.0	4	0
44	4471	6	40	20	3	8	0.0	63	0	1.0	0	0
45	4210	6	25	20	5	5	0.4	1394	0	1.0	7	0
46	4209	4	25	20	3	13	0.4	2832	0	1.0	9	0
47	4208	10	125	30	35	23	0.5	934	1	1.0	7	0

RESULTS OF ANALYSES

NUMBER NUV.	ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
48	4402	2	40	36	6	10	*	*	1	0.5	*	*
49	4405	4	40	60	125	16	*	*	0	*	*	*
50	4403	4	75	40	6	16	*	*	0	1.0	*	*
51	4404	2	40	30	*	*	*	*	0	*	*	*
52	4221	10	60	80	75	33	*	*	0	2.0	*	*
53	4330	4	60	30	18	23	*	*	0	2.0	*	0
54	4407	4	25	16	5	13	0.0	62	0	3.0	5	0
55	4406	2	25	40	5	3	0.0	391	0	1.0	0	0
56	4421	2	25	36	3	8	0.0	18	0	0.0	4	0
57	4420	6	40	30	8	8	0.0	573	0	0.5	5	0
58	4423	4	40	16	3	5	0.0	42	0	0.5	5	0
59	4429	6	25	30	0	5	0.4	95	0	0.5	7	0
60	4429	2	40	16	3	10	*	*	0	0.5	*	0
61	4464	2	50	24	13	13	0.0	348	0	2.0	4	0
62	4463	4	20	16	5	13	0.4	95	0	1.0	0	0
63	4234	0	25	6	0	5	*	*	0	*	*	*
64	4358	6	75	16	10	33	*	*	0	*	*	*
65	4295	10	75	10	40	22	0.0	5040	0	1.0	5	*
66	4346	36	900	40	*	*	*	*	32	*	*	*
67	4348	10	125	40	*	*	*	*	0	4.0	*	*
68	4347	20	50	30	5	13	0.0	202	0	1.0	7	0
69	4204	6	100	16	10	18	0.5	778	1	3.0	12	0
70	4205	6	150	16	48	45	0.0	446	8	2.0	10	0
71	4207	16	125	30	29	28	0.7	924	0	2.0	12	0
72	4208	10	60	10	18	25	0.4	7280	1	2.0	14	0
73	4242	6	100	10	20	25	0.7	2025	48	2.0	8	*
74	4241	6	75	16	60	20	0.6	4890	0	2.0	10	*
75	4240	2	40	6	0	10	*	*	0	2.0	*	0
76	4329	2	50	30	25	25	*	*	0	*	*	0
77	4328	6	110	60	18	23	*	*	0	2.0	*	0
78	4425	10	60	60	*	*	*	*	*	*	*	*
79	4424	6	60	250	*	*	*	*	0	*	*	*
80	4495	2	20	16	3	3	0.4	100	0	1.0	0	0
81	4494	4	15	20	3	5	0.0	83	0	0.5	5	0
82	4419	2	25	40	3	3	0.0	57	0	1.0	8	0
83	4419	6	40	40	5	15	0.5	88	0	3.0	6	0
84	4427	4	40	120	18	8	*	*	0	0.5	*	0
85	4499	10	40	16	5	13	0.0	110	0	2.0	11	0
86	4426	6	50	30	6	16	*	*	0	1.0	*	0
87	4500	10	25	30	5	8	0.0	80	0	2.0	5	0
88	4436	0	25	40	3	3	0.0	32	0	0.5	0	0
89	4437	0	25	20	3	3	0.0	8	0	0.5	0	0
90	4442	2	20	20	3	5	0.0	68	0	0.5	0	0
91	4441	4	15	16	3	5	0.0	38	0	1.0	0	0
92	4440	2	15	20	5	5	0.0	62	0	1.0	5	0
93	4259	0	15	10	3	3	*	*	0	0.0	*	*
94	4349	6	40	24	5	10	0.0	152	0	6.0	9	0

RESULTS OF ANALYSES :

NUMERO NOUV.	NUMERO ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
95	4350	6	50	40	8	20	*	*	0	*	*	*
96	4211	6	40	16	5	15	0.5	476	0	6.0	8	0
97	4212	4	60	16	38	19	*	*	0	5.0	*	0
98	4213	16	60	40	148	13	*	*	0	2.0	*	*
99	4214	4	50	40	*	*	*	*	0	*	*	*
100	4215	16	140	36	13	43	0.4	2062	0	10.0	11	0
101	4243	10	90	16	18	23	0.6	2389	1	2.0	7	*
102	4416	6	50	40	*	*	*	*	0	*	*	*
103	4272	10	40	16	7	16	*	209	0	1.0	*	30
104	4327	10	60	90	10	38	*	*	0	2.0	*	*
105	4499	4	40	30	3	8	0.0	39	0	2.0	0	0
106	4360	6	60	10	17	20	*	*	1	3.0	*	20
107	4359	0	40	6	0	17	0.0	50	0	4.0	0	30
108	4357	0	50	10	3	12	0.4	60	0	2.0	0	40
109	4358	20	60	6	10	32	0.4	204	0	16.0	0	40
110	4339	10	60	60	19	28	*	*	1	*	*	*
111	4338	*	*	*	*	*	*	*	*	*	*	*
112	4337	*	*	*	*	*	*	*	*	*	*	*
113	4351	4	400	40	*	*	*	*	*	*	*	*
114	4352	2	15	30	*	*	*	*	0	*	*	*
115	4270	24	50	16	15	28	0.6	253	0	2.0	0	10
116	4280	4	15	10	3	8	0.6	95	0	1.0	0	15
117	4279	2	25	10	5	10	0.0	105	0	0.5	5	20
118	4278	2	25	16	5	12	0.0	395	0	0.5	6	30
119	4277	4	75	10	7	15	0.0	126	0	0.5	0	24
120	4276	6	40	16	7	10	0.0	132	0	0.5	5	36
121	4275	6	40	10	5	13	0.7	131	0	0.5	5	36
122	4274	2	25	16	5	13	0.0	171	0	1.0	5	20
123	4273	6	60	20	57	23	0.4	*	0	*	0	20
124	4271	20	40	40	10	32	0.6	239	0	2.0	5	20
125	4400	2	40	16	5	13	*	*	0	1.0	*	*
126	4399	2	50	10	10	17	0.0	222	0	2.0	5	24
127	4398	6	75	6	17	20	0.7	378	0	2.0	0	30
128	4397	16	60	10	15	25	0.4	212	0	3.0	4	20
129	4492	30	50	30	5	15	0.0	153	0	2.0	6	0
130	4493	24	15	20	5	10	0.0	92	0	1.0	6	0
131	4336	*	*	*	*	*	*	*	*	*	*	*
132	4282	24	50	10	15	43	1.1	367	0	2.0	16	30
133	4303	6	50	20	5	13	0.5	127	0	0.5	5	0
134	4305	20	60	20	45	380	*	*	1	*	*	*
135	4304	4	90	60	68	25	*	*	1	1.0	*	0
136	4353	4	15	20	0	8	0.0	72	0	0.5	4	0
137	4401	6	15	30	*	*	*	*	0	*	*	*
138	4239	2	40	10	100	38	0.6	2479	0	1.0	14	0
139	4491	4	15	24	3	5	0.0	92	0	1.0	6	0
140	4490	6	15	30	3	8	0.0	82	0	1.0	0	0
141	4234	4	20	10	0	3	*	*	0	*	*	0

RESULTS OF ANALYSES

SAMPLE NUMBER	ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
142	4226	2	15	10	5	3	0.6	23	0	0.0	5	0
143	4461	2	25	30	0	5	0.0	97	0	0.5	4	0
144	4331	6	60	40	*	*	*	*	*	*	*	*
145	4291	6	15	6	3	12	0.0	95	0	2.0	0	40
146	4332	2	90	20	*	*	*	*	0	*	*	*
147	4216	10	60	60	15	15	*	*	1	2.0	*	*
148	4217	4	50	36	10	16	*	*	0	*	*	*
149	4218	6	25	30	8	13	0.0	1199	0	1.0	7	0
150	4244	4	50	10	7	14	0.4	170	0	0.0	6	20
151	4225	6	40	60	35	8	1.0	1453	0	1.0	9	0
152	4238	4	60	10	10	20	0.4	1842	0	1.0	5	0
153	4237	4	15	6	0	4	0.0	30	0	0.0	0	0
154	4236	6	25	16	0	15	*	*	0	0.5	*	0
155	4323	2	40	16	5	3	*	*	0	*	*	*
156	4235	10	25	16	2	12	0.4	87	1	0.0	0	0
157	4324	4	40	20	5	3	0.0	396	0	2.0	5	0
158	4325	2	50	20	8	3	0.4	366	0	1.0	11	0
159	4322	4	15	16	3	5	0.0	43	0	0.5	4	0
160	4488	6	25	30	3	8	0.7	48	0	0.5	4	0
161	4439	10	25	30	3	13	0.4	100	0	1.0	6	0
162	4435	0	60	30	3	5	*	*	0	*	*	0
163	4434	0	40	30	3	5	*	*	0	*	*	*
164	4227	4	50	20	13	3	0.7	1259	0	1.0	10	0
165	4438	0	15	16	3	3	0.0	80	0	1.0	0	0
166	4310	6	50	50	18	5	0.6	3382	1	2.0	12	0
167	4311	4	60	30	28	8	0.4	2932	0	2.0	12	0
168	4312	2	60	200	55	5	*	*	1	*	*	*
169	4309	6	40	20	3	15	0.5	206	0	0.5	5	0
170	4303	4	40	20	3	3	*	*	0	0.5	*	*
171	4307	10	60	50	8	8	0.4	1015	0	1.0	6	0
172	4306	6	50	40	28	18	*	*	0	2.0	*	0
173	4406	60	75	100	8	25	*	*	0	0.5	*	*
174	4407	6	50	20	0	15	0.0	341	0	2.0	5	0
175	4224	2	40	16	3	8	*	*	0	*	*	0
176	4223	4	25	16	3	5	0.0	122	0	0.5	7	0
177	4255	0	15	16	5	10	0.4	169	0	0.5	0	*
178	4356	0	15	10	0	5	*	*	0	2.0	*	*
179	4496	20	75	36	13	15	0.7	676	0	2.0	7	0
180	4497	16	50	36	3	13	0.4	88	0	1.0	6	0
181	4232	4	15	6	0	5	*	*	0	0.0	*	*
182	4433	4	50	24	3	5	*	*	0	1.0	*	0
183	4229	2	15	16	5	3	0.6	203	0	0.5	0	0
184	4228	2	40	60	35	3	*	*	0	0.0	*	0
185	4439	4	20	16	8	8	*	*	0	2.0	*	0
186	4333	6	90	20	28	18	*	*	0	*	*	0
187	4334	16	180	60	33	33	*	*	0	2.0	*	0
188	4480	6	40	20	5	8	0.0	53	0	1.0	4	0

RESULTS OF ANALYSES

NUMERO NOUV.	NUMERO ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
199	4481	4	50	16	13	13	0.0	285	0	2.0	6	0
198	4483	6	25	20	3	8	0.4	62	0	1.0	5	0
197	4482	10	40	16	3	10	0.6	88	0	3.0	8	0
192	4484	10	50	30	3	5	*	*	0	2.0	*	0
193	4485	24	50	20	8	10	0.0	88	0	2.0	7	0
194	4475	6	25	40	3	3	0.0	20	0	0.5	0	0
195	4474	20	75	20	5	15	*	*	0	1.0	*	0
196	4231	10	50	4	17	27	0.5	325	1	0.5	5	*
197	4230	6	25	6	0	5	0.0	40	0	0.0	0	0
198	4233	6	15	6	*	*	*	*	*	*	*	*
199	4409	6	40	24	0	8	0.0	162	0	0.5	7	0
200	4410	4	50	20	0	13	*	*	0	1.0	*	*
201	4411	40	110	60	*	*	*	*	8	4.0	*	*
202	4412	6	90	24	*	*	*	*	12	3.0	*	*
203	4363	0	15	6	3	7	0.0	55	0	1.0	0	30
204	4413	16	250	100	*	*	*	*	0	2.0	*	*
205	4414	16	50	100	384	26	*	*	0	*	*	*
206	4415	6	40	60	13	13	*	*	0	1.0	*	0
207	4321	6	15	20	*	*	*	*	0	*	*	*
209	4320	4	40	16	5	3	*	*	0	1.0	*	0
209	4365	0	25	16	3	8	*	*	0	1.0	*	*
210	4319	10	50	20	8	13	0.0	386	0	1.0	7	0
211	4318	6	60	20	8	23	*	*	0	1.0	*	0
212	4317	6	60	16	*	*	*	*	0	*	*	*
213	4316	2	50	16	8	10	0.0	46	0	0.5	6	0
214	4315	4	25	40	3	3	*	*	0	1.0	*	0
215	4314	2	15	20	5	8	0.0	114	0	1.0	7	0
216	4313	6	25	20	5	8	0.4	55	0	1.0	5	0
217	4479	10	25	20	3	10	0.0	60	0	2.0	0	0
218	4259	0	25	6	0	7	0.0	95	0	0.0	0	20
219	4477	20	50	20	3	8	0.0	141	0	1.0	6	0
220	4476	6	40	20	3	3	0.0	33	0	0.5	0	0
221	4368	6	60	20	33	20	*	*	0	3.0	*	30
222	4367	6	90	16	15	12	*	*	0	*	*	20
223	4256	20	40	16	320	30	*	*	0	1.0	*	30
224	4361	0	40	20	0	5	0.0	111	0	1.0	0	50
225	4362	*	*	*	*	*	*	*	*	*	*	*
226	4354	2	25	20	0	3	0.0	42	0	0.5	0	0
227	4258	4	90	10	28	15	0.5	4140	0	1.0	5	20
228	4257	6	25	16	10	10	0.0	388	0	1.0	0	20
229	4478	6	25	16	3	8	0.0	103	0	2.0	8	0
230	4369	*	*	*	*	*	*	*	*	*	*	*
231	4302	6	50	16	8	5	0.6	157	0	0.0	4	0
232	4269	6	50	10	5	7	*	*	0	1.0	*	*
233	4373	2	50	10	5	10	0.4	238	0	2.0	0	*
234	4372	6	60	16	20	20	*	*	0	*	*	36
235	4248	2	60	6	43	18	*	*	0	0.0	*	*

RESULTS OF ANALYSES

NUMBER NOV.	ANC.	CU	ZN	PB	CO	NI	AG	MN	MO	U	SB	SN
236	4371	0	25	10	*	*	*	*	0	*	*	*
237	4372	6	60	20	80	25	*	*	0	*	*	*
238	4468	0	50	10	13	15	0.7	508	0	28.0	0	20
239	4301	10	75	16	10	6	*	*	0	*	*	*
240	4385	4	50	20	28	7	0.4	1132	0	2.0	8	20
241	4247	4	25	10	30	12	0.4	2299	0	0.8	5	*
242	4332	6	50	20	25	23	0.6	478	0	4.0	4	*
243	4311	6	10	20	3	17	0.0	134	0	0.5	6	20
244	4390	0	15	20	3	9	0.0	103	0	1.0	4	*
245	4266	10	50	20	12	23	0.5	122	0	4.0	4	30
246	4251	10	50	10	20	20	*	*	0	*	*	*
247	4250	6	40	6	28	17	*	*	0	1.0	*	30
248	4249	4	25	10	5	12	0.0	337	0	0.0	0	20
249	4257	0	25	16	8	7	0.0	565	0	0.5	5	30
250	4383	20	150	40	90	43	*	*	0	10.0	*	*
251	4384	10	90	140	55	30	*	*	0	*	*	*
252	4379	6	15	10	12	15	0.0	203	0	3.0	6	20
253	4377	0	25	10	23	13	*	*	0	*	*	*
254	4378	0	25	16	10	10	*	*	0	*	*	24
255	4260	6	50	10	25	25	*	*	0	0.5	*	*
256	4261	2	25	6	5	14	0.0	60	0	0.0	0	30
257	4265	6	75	40	208	20	0.6	2590	0	1.0	7	30
258	4262	4	40	16	3	16	0.0	128	0	0.0	0	20
259	4263	20	90	16	15	42	0.8	173	0	7.5	6	40
260	4246	2	15	6	3	8	0.4	107	0	0.0	5	20
261	4386	4	40	16	7	15	0.5	179	0	2.0	6	24
262	4245	2	25	6	7	3	0.4	270	0	0.0	0	*
263	4387	0	40	16	6	10	*	*	0	*	*	*
264	4388	4	50	10	12	13	0.4	438	0	4.0	5	10
265	4389	4	40	16	7	12	0.4	289	0	2.0	0	20
266	4390	0	15	10	*	*	*	*	0	*	*	*
267	4376	10	50	10	18	18	0.9	1235	0	3.0	12	*
268	4264	10	90	10	33	35	0.6	3682	0	2.0	5	20
269	4391	2	15	10	3	7	0.4	103	0	1.0	5	40
270	4392	2	75	6	*	*	*	*	*	*	*	*
271	4393	4	40	10	5	8	0.0	342	0	1.0	0	24
272	4394	16	50	16	5	12	0.5	320	0	0.5	0	*
273	4395	4	50	6	8	15	*	*	0	*	*	45
274	4396	15	100	10	20	48	0.9	1097	0	2.0	6	20
275	4374	0	25	6	0	9	0.0	NS	0	2.0	6	30
276	4375	2	60	16	20	20	*	*	0	*	*	*

Asterisk (*) indicates missing result for element concerned.

SERVICE DE LA REPROGRAPHIE
Octobre 1973

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